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East Europe Report

SCIENTIFIC AFFAIRS

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HUNGARY

POLAND

HUNGARIAN PARTICIPATION, INSTRUMENTATION IN SOVIET SPACE VEHICLES

Budapest ORSZAG-VILAG in Hungarian No 22, May 80 pp 12-13

[Article: "Hungarian Research-Space Vehicle Work Program; Joint and Independent Experiments in Space"]

[Text] The news of sending the first Hungarian astronaut was received with extraordinary interest throughout the country. This is understandable, because for the first time in our history a son of our homeland was in orbit around Earth, and this in itself was no small event. But how should we evaluate from a scientific viewpoint the participation of a Hungarian astronaut in the work being done on Salyut-6?

As we pointed out in our series titled "Milestones in Space Research" last year, our experts have done and are doing successful work in a few special areas of space research. In harmony with our activity conducted thus far in the Interkosmos medical-biological and resource research experiments figured primarily in the work program of the Hungarian astronaut.

A Butterfly in a Space Station

The medical-biological experiments include a so-called dose experiment done with an instrument called the butterfly. On 12 May PRAVDA wrote as follows about the instrument of Hungarian manufacture: "This is extremely important because it makes it possible to check the degree of cosmic radiation in an operational way both on board and outside the space station."

As is well known, the fixed stars release other forms of radiation in addition to visible light, including ionizing radiation of various types and energies (X-rays, electrons and heavier charged particles). The nearest radiation source to Earth is the sun so it is primarily the ionizing radiation of the sun which reaches the biosphere or space ships circling the Earth. Because of the diverting (protecting) effect of the magnetic field of Earth and the effect of the atmosphere in decreasing the strength of the radiation, the so-called cosmic radiation reaching the surface of the Earth is so small that it is not dangerous to life or health. More precisely, life, the entire biosphere, developed in just this environment and in many respects (mutation, etc) the radiation reaching Earth is a condition of life too.

But the inhabitants of a space station circling Earth are protected only by the thin wall of the space station and not by the radiation-attenuating effect of the atmosphere--which is equal to a layer of water 10 meters thick. The wall of the space ship can significantly decrease the harmful effect only of low-energy radiation. Thus the intensity of the radiation on a space ship is several 100 times greater than on the surface of Earth. The radiation load affecting the astronauts on the space station is probably as great as is permitted, for example, in an isotope laboratory. This is still not dangerous to humans. In addition, the magnetic field of Earth still protects space stations circling Earth at an altitude of several hundred kilometers.

With increased solar activity and especially in the event of a disturbance of the magnetic field around Earth, however, the intensity of the ionizing radiation can increase significantly. The radiation safety of the astronauts thus requires regular measurement of the degree of the radiation load during flight. Because of their small size, broad range of measurements and great precision, the so-called thermoluminescent dosimeters can be used advantageously for this purpose.

Their operating principle is simple. The crystaline material in them changes slightly as a result of radiation. Nothing of this can be seen with the naked eye, but if it is heated it regains its original condition and in the meantime it releases as much light as the radiation it received. Thus the name of the phenomenon, thermoluminescence. Measuring this light is thus suitable for measuring the radiation dose.

At the beginning of the 1960's they were still using a 150-kilogram device for this purpose. The Hungarian researchers developing dosimeters joined the Interkosmos program in 1970. The TLD-03 and TLD-04 (TLD is an abbreviation for thermoluminescent dosimeter) were developed in the Central Physics Research Institute [KFKI]. Laboratory devices the size of a small TV set have been regularly used for years to measure, after the fact, the radiation affecting Soviet astronauts and they have also been successfully used to control radiation treatment of cancer patients. The TLD-04 and the butterfly developed for space flight will also be used to protect workers at the Paks nuclear powerplant and to measure radiation reaching the environment.

In the KFKI they recently developed a much smaller device, the size of three match boxes and weighing hardly 1 kilogram. Dr Sandor Deme, a deputy main department chief, demonstrated its operation in one of the experimental laboratories of the KFKI. He first put the thermoluminescent material in front of a beam of radiation and then placed it, like a key, in the instrument called the butterfly. After a few moments the instrument indicated the radiation dose in numbers.

Even before this the Soviet astronauts carried dose-measuring materials with them but these could be evaluated only later, on Earth, with the TDL-04 or a similar machine. One of the greatest advantages of the new Hungarian instrument is that with its aid the space researchers can check themselves,

on the space ship or even during a space walk, the degree of radiation affecting them at a given place and time. It got its name, butterly (pille), on the basis of its very small weight and size. It takes up one-twentieth the space of, and weighs only one-fifteenth as much as, the TDL-04.

This marvelous little device is now on board the Salyut-6 and in the hands of the first Hungarian astronaut is checking the life and health of those working there. Great help in developing it was given by, among others, those working in the Radiation Protection Main Department, led by Dr Istvan Feher, and in other sections of the KFKI and by Academician Laszlo Bozoky, who has been working on studies of the effects of radiation for years at the Budapest Oncology Institute.

The Interferon Experiment

The Hungarian medical-biological research to be done on the Salyut-6 includes the interferon experiment too.

Interferon, which was discovered more than 20 years ago, is a protein generated in vertebrate animals and in the human organism which develops a defensive capability in cells against the most varied viruses, influences the proliferation of normal and tumorous cells and plays a role in regulating the immunological mechanism of the organism. It has also proven to have a radiation-protection effect.

Within the framework of the Interkosmos program the Microbiological Research Group of the Hungarian Academy of Sciences has been dealing with interferon research for more than a decade. It was here that they planned and worked out the experiment to be done on Salyut-6 by the Hungarian astronaut with the help of equipment prepared in the Medicor Works.

The experiment consists of three parts. In the first, they will examine how the special circumstances of space travel influence the generation of interferon in a culture of human white blood cells. A culture of white blood cells and various materials which generate interferon were placed in the test tubes of the apparatus manufactured for the experiment separated from one another by a one-way value. It is the task of the astronaut to place the apparatus in a thermostat which has a temperature of 37 degrees Celsius: when the cell culture reaches the average temperature of the human organism the plungers of the test tubes are screwed in. With the screwing in of the plunger, a fluid which aids the development of interferon goes into the space holding the cell culture and starts the generation of interferon. The results will be evaluated after they return.

With this experiment, they expect an answer to how the cosmic environment (weightlessness and cosmic radiation) influences interferon generation. If it turns out that it is a good bit stronger here than on Earth then it would be worth attempting to produce highly effective interferon preparation in space laboratories in the future.

For the second experiment, the astronaut carried with him various interferon preparations. In equipment designed for this purpose, he will see how the cosmic conditions influence the antiviral effect of the interferon medical preparations.

With the increase in space travel, it may happen that despite the strictest preventive measures some sort of dormant viral infection will cause sickness on a space station. In the event of a favorable result from these experiments, it can be imagined that the medicine chest of the astronauts will be complemented with various interferon preparations.

According to the program of the third experiment, blood samples will be taken from the astronauts before launch and after return and the generations of interferon will be initiated in the white blood cells obtained from these samples. Since the ability of the human organism to produce interferon is one index of the defensive mechanism of the organism, the experiment will also be a test of how extreme burdens and special conditions affect the human organism. This may cast light on previously hidden changes which have taken place in the human organism during space flight.

A Hungarian Patent in Space

The work program of the Hungarian astronaut includes use of a new Hungarian instrument to evaluate ability to perform intellectural work. The device, called the Balaton, was developed by physicians of the Flight Surgeons' Testing and Research Institute together with the engineers of the Medicor Works. The 420-gram instrument, containing a microprocessor, is the size of a hand and is actually a very easily handled minature computer which operates in various operational modes and can carry out 32 programs.

For example, one can measure reflexes by setting it up so that a button has to be pushed upon a light signal. The program is more complex if one must always choose the appropriate button for four different signals. At the end of the program, the device automatically sums up and evaluates the incorrect answers and the reflex time. In another operational mode, the galvanic resistance of the skin can be used to measure the pulse; indeed, it is possible to measure "biological feedback" (that is, the involuntary influence on the pulse or skin resistence). In this case, a sound corresponding to the given value can be heard in the earphones of the device. Attending to the sound with great concentration, the astronaut himself can reduce his pulse or the excitement appearing as perspiration (which changes the electric resistance of the skin). In this way, the device has a calming effect, can faciliate more intensive rest and the regeneration of work ability and the nervous system.

It is well known that in the course of their many activities the pilots must divide their attention. How can they do this satisfactorily? This also can be measured by the instrument in that while carrying out certain tasks they must answer the light or sound signals of the device--with a speed which can be set at will.

The expression in mathematical form of the ability to do intellectual work is a Hungarian patent. The program was worked out jointly by Soviet and Hungarian experts and the Soviet space researchers, in addition to the Hungarian astronaut, will subject themselves to the experiment. It is obvious that by knowing the changes in the work ability of pilots and astronauts--or others performing intensive intellectural work--it will be possible to make the division of labor more rational, to organize work and rest more rationally even on Earth.

The Hungarian astronaut on the Salyut-6 will also participate in resource research, which is especially important to our national economy, primarily from agricultural, soil-study, water-affairs and environmental-protection viewpoints.

The essence of the series of resource research experiments planned for the joint flight is that they will perform measurements simultaneously in four selected areas from the space station, from the air and on Earth--within the framework of the "Expedition" program.

From the Salyut space station they will take pictures from an altitude of about 300 kilometers of predetermined regions of Hungary, using an MKF-6 M six-channel camera in various wave lengths of light (green, red, etc.).

Pictures of these same regions will be taken from an altitude of about 6,000-7,000 meters by a Soviet AN-30 air laboratory coming to our country.

Pictures will also be taken of the designated areas from an altitude of 1,700-2,700 meters, using helicopters, and from an altitude of about 1,000 meters they will take so-called heat pictures with special thermovisual equipment.

For purpose of comparison they will also do meteorological measurements and take soil and water samples on the ground in the designated areas at the same time.

Balaton From Space

An intensive examination of Lake Balaton also figures in the program of the researchers working on the Salyut-6. They will study the pollution of the lake, its sources, the shore and open-water vegetation, primarily of Little Balaton, and the condition of the Balaton highlands and the Somogy shore. The interested Hungarian water-affairs organs are participating in the research work too.

An examination of the region along the Tisza between Szolnok and Kiskore also has a place in the program. The purpose of this is to prepare a soil map and to establish how the data obtained can be used in planning soil improvement. They expect an answer to the question of how the Kiskore reservoir will affect the formation of internal water and alkalization.

A thorough study of the Hungarian section of the Danube is an important experimental task. The purpose of these investigations--which will continue in the future--is to study those effects which hydroelectric, thermal and eventually nuclear powerplants will have on the river and its environs.

Development of the program began in May 1979. At that time, the Soviet crew of the Salyut-6 space station photographed about 60 percent of the territory of Hungary. The Soviet AN-30 flying laboratory visited our homeland at the same time too. The Hungarian and Soviet researchers completed the tasks of the first phase of the "Expedition" program completely and successfully. The processing of the data obtained in the first phase of the experiment has been going on since; the work will be guided by the joint Hungarian-Soviet space flight this year and will be continued as part of the Salyut program.

The Hungarian astronaut will also participate in adding color to the rest and amusement program of the space station. The program developed by Soviet scientists and used successfully thus far fundamentally ensures the filling of free time.

Hungarian experts recommended and compiled a supplement to this for the time of the joint space flight. For example, they will show on the Salyut-6 a compilation of Hungarian films which the staff of Hungarian TV prepared especially for this purpose.

PHOTO CAPTIONS

1. p 12. The TLD-04 thermoluminescent dosimeter. Radiation sensitive materials reminiscent of pills are placed at various points on the space station and are brought back to Earth where the degree of radiation received is established with the dosimeter.

2. p 12. The weight and size of the butterfly (pille) are hardly one-twentieth that of the TLD-04. The astronauts need only place the key-like radiation sensors into the opening of the device. When they are turned they warm up inside the device and in a few moments numbers appearing in the little dark window on the left side indicate the magnitude of the radiation suffered.

3. p 13. The device prepared at Medicor for the Interferon-1 experiment.

4. P 13. The Balaton instrument for evaluating ability to do intellectual work will fit into the palm of the hand.

8984
CSO: 2502

SCIENTIST DWELLS ON SPACE RESEARCH PROJECT IN 1981

Sofia TEKHNICHESKO DELO in Bulgarian 31 May 80 p 11

[Interview with Senior Scientific Associate and Candidate of Physical Sciences Stefan Chapkunov of Central Space Research Laboratory of the Bulgarian Academy of Sciences, place and time not indicated, by Vasko Delev: "Experiments with Bulgarian Space Instruments--Preparation of the Bulgaria-1300 Satellite"]

> [Text] In 1981 an artificial satellite by the name of Bulgaria-1300 will be launched in the northern latitudes of the USSR. It will be put into circular orbit with an inclination of 81° and an altitude of 900-950 km. The scientific program and the instruments on board will be the work of Bulgarian scientists and designers. The operating models of the instruments are already finished and this was the occasion for our meeting with Senior Scientific Associate and Candidate of Physical Sciences Stefan Chapkunov of the Central Space Research Laboratory of the Bulgarian Academy of Sciences, under whose guidance they were developed.

"I want to mention," Senior Scientific Associate Stefan Chapkunov began, "that few countries in the world have undertaken such an experiment. In addition to the USSR and the United States, out of the Western European countries that are leaders in space research, only Italy has launched a satellite--the San Marco, but it has limited scientific functions. We have made a detailed plan and mapped out the parameters that must be measured. Thus, for the first time in the Intercosmos program the decision has been made that a satellite of the Meteor type, specialized for meteorological research, should be adapted for performance of the scientific program."

[Question] In what respects will the satellite differ from the other Meteors?

[Answer] It will have a significantly greater payload capability. Hitherto satellites carrying scientific instruments had a payload under 100 kg,

but this one will have 25[illegible] kg of instruments on board. It will have an active life of a year and a half (period during which the instruments operate and transmit information), whereas in the others it is about 6 months. Another significant feature is that its three-axis stabilization is much higher.

[Question] What do the scientific instruments include?

[Answer] The satellite will carry 12 Bulgarian instruments. Three-quarters of these are unique. The entire instrumentation will be controlled by original automatic equipment designed at the Space Research Institute in the USSR.

[Question] What parameters of outer space will be measured in this scientific experiment?

[Answer] For 10 years now we have been measuring structural plasma parameters such as temperature and ion and electron concentrations. Now one and the same parameter will be determined by two different methods. This will make it possible to evaluate the practicality of the particular method. We shall still measure plasma drift, the variable component of an electromagnetic field, the composition by mass of ions, low-energy protons and electrons, photons etc. There will also be a passive element on the satellite--a reflector of the laser-satellite system. It is a device of quartz hexahedral glasses. From the rays trapped by it conclusions are drawn regarding the state of the atmosphere and certain geophysical problems are solved. The reflector will continue its measurements even when the satellite ceases to be an actively operating body and turns into an ordinary meteorite.

[Question] Will a similar space scientific program be carried out by other countries?

[Answer] Last year at the international seminar on optical emissions and ionospheric research American specialists reported on their project of the AE satellite which will be launched at the end of 1980. Its scientific program almost overlaps with ours so we shall be able to compare the results of the two experiments.

[Question] What scientific potential was committed to the development of the instruments and what are the impending missions?

[Answers] For 2 years the personnel of 17 ministries have been engaged in working out the preliminary plan. Work on the individual instruments did not begin until March 1979, but the operating models have already been delivered. This is a very short time by world standards. The Bulgarian instruments are now in the USSR. Operation tests, which are a kind of dress rehearsal before the satellite is launched, are impending. Very high specifications are set for the instruments: vibration resistance

up to 10 Gs, impact resistance up to 100 Gs, linear acceleration loads in the centrifuge, temperature tests up to 60-70^0 etc. At the moment a large group of Bulgarian scientists is simultaneously taking part in the preparation of the next Vertical rocket in the series, on which four of our instruments will be carried. They will be exact copies of some of those which will be on the Bulgaria-1300 satellite. The object is to see how they will function under space conditions. This will facilitate their more accurate calibration. All criticisms received during the tests will be eliminated in the flight models.

6474
CSO: 2202

BRIEFS

NEW INSTITUTE FACILITY--The Institute for Research, Production and Utilization of Radioisotopes became operational yesterday at a new, modern facility located in Prague 10-Hostivar. The building is equipped with technological apparatus necessary for further research, development and services pertaining to sealed sources, designated organic compounds, dosimetry, radiation chemistry and utilization of ionizing radiation. [Prague PRACE in Czech 2 Jul 80 p 3]

POWER STATION PROJECT--The pump-storage hydroelectric power station in the Desna Valley in Hruby Jesenik will be situated 1,350 meters above sea level and will bring water through pipes from the altitude of 550 meters to four Francis turbines. The main aggregates of the station will be situated in a subterranean rock chamber and the installed output will amount to 600 megawatts. The station will supply power to the north Moravian region and a part of eastern Bohemia. The built-up dam of the lower reservoir will be 50 meters high and will hold almost 3 million cubic meters of water. Work on the project has started. [Prague ZEMEDELSKE NOVINY in Czech 5 Jun 80 p 6 AU]

NEW PHONE EXCHANGE--A new automated telephone exchange, type MK-611, was put into operation on 13 June in Jablonec and Nisou. The new exchange, which is a second-generation MK-611 one, is the first of its kind to be produced in the CSSR. It was designed and produced by the Tesla Karlin Enterprise in cooperation with the Prague Communications Research Institute. The technical equipment and assembly cost approximately Kc$ 13.5 million. The exchange will expand intercity automated connections and make possible direct dialing to 20 states. [Prague RUDE PRAVO in Czech 14 Jun 80 p 1 AU]

CSSR MACHINERY FOR CUBA--Skoda Works in Klatovy has produced the first two of the seven combustion chambers ordered for the nickel plant in Punta Gorda, Cuba. Each of the chambers has a maximum output of 32,000 kilowatts. The chambers, manufactured under a Soviet license, burn gasses produced by nickel blast furnaces and thus reduce consumption of mazut from 2,800 kg to 450 kg per hour. The combustion chambers are a part of industrial equipment deliveries to Cuba by Prerov Machine Works, in which the Skoda Works in Klatovy has been participating. [Bratislava PRACA in Slovak 27 Jun 80 p 2]

FUNCTIONS OF TECHNOLOGICAL CENTERS OUTLINED

East Berlin DIE WIRTSCHAFT in German Vol 35 No 5, 15 May 80 p 11

[Article by L. Erfurt and B. Neumann, Research Offices, Ministry for Science and Technology: "How Necessary Are Technological Centers?"]

[Text] Since science and engineering become effectual principally through technology, one of the decisions in the November 1977 resolution of the Council of Ministers concerning raising the level of technological work was that technological centers in important manufacturing areas should be expanded. Their purpose is to develop highly effective, technological solutions and to disseminate the most recent findings and experience in a technological area rapidly and on a scale appropriate to the economy of the GDR.

Technological centers exist or are being expanded in diverse areas of industry, for example, in the chemical industry, electrical and electronics, heavy machinery and plant construction, machine tool and manufacturing machinery and glass and ceramics. At the Central Institute for Welding Technology, Halle, the Research Center for Machine Tool Construction, Karl-Marx-Stadt, and the Research Center for Processing Technology, Zwickau, years of experience have been applied effectively in their work as research centers.

Successful centers have at least three things in common:

First, they bring together scientists, engineers, technicians and skilled workers who possess great technical knowledge and rich practical experience in one area of specialization. Putting this knowledge at the disposal of a large circle of users assures that the center will become an important source of information and continuing education for the combines and plants. Second, conditions are favorable for gaining a sceintific-technical lead on a high, creative level, which makes the technological center a research center in its field. The effects can be intensified greatly by the rapid transfer of results to the production process and by the broadest possible practical application--as, for example, the experience gained at the ZIS [Central Institute for Welding Technology] Halle demonstrated.

Third, they can exercise effective influence for the application of the results of scientific-technical progress according to the economy's needs. By passing on technological experience and actively offering the results of technological research in the industrial combine, the branches and in industry as a whole, through a comprehensive use of the results of international scientific-technical cooperation they are, so to speak, "coordinating centers" in their field. As such, they have a great interest in gradually eliminating existing discrepancies in the technological level of production.

The Responsibility of the Combines

The directors of the combines or major enterprises bear the responsibility for the work of the technological center. They guarantee that the institution carries out projects not only within the combine but also within the framework of the economy. The projects are integrated into the plan for science and technology of the combine or major enterprise. They can be financed--as provided for in the resolution about technology--from funds in the state budget for science and technology. High employee productivity is to be stimulated more effectively by project-oriented bonuses and special prizes, etc.

In order to further raise the technological level of production some branches of industry need to show a greater willingness to develop inter-disciplinary technologies, to expand the capacity of technological centers and to orient their capacity for expanding industrial efficiency more strongly towards the practical application of technological progress.

Purveyors of Information

Their work in information is of special importance. They evaluate national and international innovations in science and technology as well as their economic effects on production, they satisfy the crucial need for information in their own combine and that of other users and they supply scientific-technical data about the most advanced processes and methods and the direction of their development. In the field of high-productivity technologies increasing socialist economic cooperation is producing the most varied results of general value which must be utilized even more effectively.

One example is the good experiences of the Research Center for Metal Forming Zwickau of the Herbert Warnke Combine for metal forming technology. By evaluating and preparing articles from more than 60 professional periodicals for electronic data processing in close cooperation with the Research Center for Machine Tool Construction Karl-Marx-Stadt the needs of the metal working industry for information about metalworking techniques were met. The Research Center has had a decisive influence on the solution of technological problems, with more than 1,000 oral and written answers to requests for advice and individual consultations annually about problems in metalforming and cutting. The results of its own research are regularly published in professional journals and made available to anyone interested.

The research center of the Karl-Marx-Stadt machine tool plant currently has available in a computer-assisted information system 'Science and Technology' about 40,000 pieces of data, such as cutting values for the use of new cutting materials, cutting values for turning unusual metals, application tables for high speed grinding, construction tables and data for various tools. In cooperation with the Central Institute for Information and Documentation (ZIID) written materials which they had in common about universally applicable standardization methods for assembly procedures were worked out and made available to wide range of users. In addition, technical knowledge is passed on at conferences and advisory sessions held by the technological divisions of the combines as well as about product groups, professional groups of the KDT [Chamber of Technology] and publications.

The Central Institute for Welding Technology has a comprehensive program for the training and continuing education of highly qualified skilled workers, for example, special courses to earn proof of qualification in the form of "welding certificates." By combining continuing exchange of experience with the systematic training of cadres significant effects can be achieved without great expenditures--principally investments.

Projects Undertaken as a Research Center

Assuming responsibility for research in a well-defined technological field means carrying out independent research projects with the aim of:

developing new or continuing the development of existing processes and technologies (for example, the Central Institute for Welding Technology Halle in the field of plasma, laser and electron beam welding);

--achieving a scientific-technical lead on a high, creative level in

--improving the efficiency of production (for example, the Research Center for Machine Tool Construction, which is developing a system for computer-assisted calculation of assembly procedures as well as methods to design manual work activity in a scientific manner, which experts calculate can possibly eliminate much assembly work time);

--improving the subsequent utility of research results to achieve a higher degree of multiple application (for example, at the Technological Center for Sheet and Solid Metal Working, work is being carried out to discover standardized solutions for the press feeds which are universally applicable in the industry). With 1,800 presses this could mean a saving of 800 to 1,000 jobs.

Considerable reserves of production can still be mobilized by cooperation with institutes of the Academy of Sciences and the universities and trade schools, as well as with other industrial research institutes and their users. In practice it is proving worthwhile to use research results from technologica centers in the associated combine, because the proof of successful first-time use convinces those in authority in other areas more quickly and smoothes the way more rapidly for technological changes to be used extensively.

Additional important results of research are the derivation of standards, norms, guide lines, normative reference data and typical technologies for the assigned work area and the development of methods of standardization. For example, the Scientific Technical Center for Chemical Plant Construction was assigned the task of developing standardization methods for chemical plant construction which are highly efficient and have a potential for later use. In the technological centers for machine tool construction and for forming technology comprehensive catalogs of standardization methods have been compiled which can be used later in building their own plant.

The assumption for any well-directed technological research is constant analysis of what is in the forefront of science and technology and its probable direction. On this basis the leadership in the combines is in the position of being able to derive and define goals for the effectiveness and quality of technological research and development which ensure a reduction in specific material and energy consumption, a saving of work and jobs, the freeing of labor, the lowering of costs, an increase in export capability and profitability and which guarantee the optimal application of scientific-technical potential.

Coordination of Forces

Finally, the responsibility for coordination in their respective special fields is one of the functions of the technological centers. Involving partners in the solution of common problems and coordinating research projects help to transmit research results more quickly and also simultaneously into a large number of factories and combines. Duplication of research is avoided and the manpower available to the combine and the economy is increased. The Technical Center for Surface Finishing in the LEW [Locomotive Construction and Electrotechnical Plant] Hennigsdorf is exemplary in this respect. Here the scientific-technical work is decided upon among the factories cooperating in the product group. Research topics from the factory producing electroplating units, from electrotechnical factories with technologies in practical plating (the manufacture of printed circuit boards) and factories with technology in conductive surface finishing are coordinated so that a higher degree of effectiveness is achieved on the levels of science and technology. Scientific cooperation embraces not only other research institutions in industry, but also institutes and institutions of the Academy of Sciences, universities and trade schools and research facilities of CEMA. The chain extending from the mutual conception of projects to their successful translation into production is thus strengthened.

Coordinating activity will increase in importance in all technological centers because raising the level of technology touches on a complex of questions which requires the involvement of the most varied scientific disciplines.

Technological supervisory offices in combines and factories have proved useful in recent years in making accessible to potential users the applicable and tested technological solutions which have resulted from the technical development of manufacturing; these solutions include highly productive standardization

methods which are useful in several areas. These offices also influence the assignment of projects of the technological centers in industry. Through closer cooperation with technological central offices and by supporting those combines and factories which are interested in improving cooperation or expanding their own capacity, the centers can raise the level of technology and help to tap important economic reserves.

9581
CSO: 2302

TROPICAL MEDICINE WARD ESTABLISHED AT KARL MARX UNIVERSITY CLINIC

East Berlin TRIBUENE in German 3 Jun 80 p 4

[ADN Article: "Special Ward for Tropical Medicine; Also Specialized Training for Foreign Student Nurses"]

[Text] Optimum diagnosis and treatment of tropical diseases has now become possible at the medical clinic of the Karl Marx University in Leipzig. The technical station for tropical medicine and clinical parasitology which has just been created here offers the best conditions to cure foreign and native patients suffering from infections and other diseases which occur exclusively in the warmer zones of the globe. The new division is linked to the outpatient clinic--which has been in existence for already 20 years--and to its special laboratories for tropical medicine.

Among the first patients of the 12-bed station were students and trainees from, among others, Ethiopia, Algeria, Guinea, the People's Democratic Republic of Yemen, Cuba, Mali and Vietnam, as well as GDR citizens who had stayed for a long time in tropical countries. The responsible work of doctors and nurses, under the direction of Dr Werner Granz, includes also specialized advice given to other doctors, and the dispensatory care of people travelling to tropical countries.

On the basis of a cooperation agreement with the Quedlinburg medical school--the central training place, in the GDR, for nurses from tropical and subtropical countries--this department (until now the only one of its kind in our republic) is organizing a six-week specialized practical course for these student nurses. According to Dr Granz: "This measure is justified in two respects: First, we are giving these girls an insight into the diagnosis and treatment of tropical diseases. This will enable them to be of immediate and effective help in their home countries. Second, these professional students, being fully integrated in our routine work, give our foreign patients a feeling of security, since in most cases they can speak to them in their native languages."

This opinion was confirmed by one of the trainees working in the department, Isabel Keto Nzinga from Angola. "I am given here every conceivable opportunity to learn what I must know in the profession I have chosen," she said.

9294
CSO: 2302

TECHNICAL DEVELOPMENT IN MACHINE INDUSTRY ANALYZED

Budapest FIGYELO in Hungarian 7 May 80 p 4

[Report by Andras Kery: "Technical Development in the Machine Industry"]

[Text] In the metallurgical and machine industry, a total of about 22,000 people are working in research and development in 10 research institutions and 84 enterprise research laboratories. They spend 6 billion forints annually for technical development. As a result of our work in development and the purchases of licenses, we begin the manufacture of about 3,000 new products every year, 80-85 percent of which comes from domestic development.

Laboratories of Research and Development
in the Machine Industry in 1978

	Number of		Annual cost in million forints	Number of tasks in R&D
	Research Places	Workers		
Machine manufacturing technology	5	909	199	347
Communication technology	13	6,985	2,403	1,546
Precision engineering	13	3,554	1,040	1,838
Automatization	1	111	38	25
High-power electric machine industry	12	3,276	871	1,861
Energy machine manufacture	2	113	39	188
Vehicle industry	7	2,212	654	1,363
Other	24	2,558	506	2,994
Machine industry's total	77	19,718	5,750	10,162

Research in certain areas is extended to more subjects than justified, without being connected to the selling processes. The manufacturers are not interested enough in applying scientific results, and thus the role of domestic research in developing a competitive product structure is still not adequate. Technological research, the perfection of the production processes of binding elements and final products, and the adaptation of foreign processes are undeveloped as well.

Updating the Production Structure

The activity of scientific research and technical development must be better coordinated with the developmental goals of production structure and the requirements of foreign economic policy. In order to speed up the reoganization of the machine industry's structure, the tasks in research and development were defined in the Fifth Five-Year Plan period on the basis of the primary economic programs. The central technical development fund gave much help to the realization of goals. The amounts paid by the KGM's [Ministry of Metallurgical and Machine Industries] enterprises for the benefit of the central technical development funds were used for research and development in the following main areas: machine manufacturing technology, electronic parts, telecommunication systems and equipment, digitally controlled machine tools and integrated production systems, farm and food industrial machines, machines and equipment for material handling and storage, up-to-date generation and use of electric power, medical instruments, and energy and environment protection.

By the end of 1980, 37 percent of the KGM's Technical Development Fund will be used for national programs, 13 percent for the portfolio's programs, and 7 percent for other important tasks.

In the future, machine industrial production structure must be updated primarily through the development of the manufacture of parts and partial units. The production of these will reach 5 percent of the machine industry's production by 1990. Within this, the development of three areas will be emphasized:

--the specialized production of parts and partial units for machines of general purpose;

--the specialized production of electronic parts;

--the specialized production of parts for highway vehicles.

There are three more areas, in addition to the background industry, the development of which should be emphasized: certain areas of the electronics industry, a few areas of the farm and food industry's machine industrial background and, finally, the manufacture of machines and appliances that make the production, distribution and supply of electric power more efficient.

The electronics industry, the farm and food industry's equipment and the machines in energy production and supply will together produce 50 percent of the machine industry's output by 1990.

Moreover, the manufacture of highway vehicles, machine tools and durable consumer products must be significantly improved. In the course of technical development, we must strive to increase the life span and to decrease the specific energy consumption of durable goods.

A faster revision of the machine industry's production structure necessitates a concentration of research and development mainly on production branches that have a high priority. These may be best realized during the Sixth Five-Year Plan by including them among the high-priority programs. These research and development objectives must be incorporated, therefore, into the National Middle-Range Research and Development Plan [OKKFT] and the programs without portfolio.

The following programs of the machine industry have been included in the OKKFT:

--specialized manufacture of machine parts;

--research in microelectronic parts, technologies and basic materials;

--research and development of farm and food industrial machines and equipment;

--development of export-oriented, complete electric and industrial systems;

--research in machine production technology;

--development of automated tools and systems;

--research and development of small computers and systems.

The projected total costs for these exceed 13 billion forints for the Sixth Five-Year Plan period.

Things to Be Done in Technical Development

In the past 20 years, the machine industry's production for each unit of machine and equipment value increased by only 1-2 percent, and the production for each working hour increased by only 6-7 percent annually. This indicates that the development of production technology is the main source of better productivity.

The intensity of technological research and development in the machine industry is less than necessary. In some places the existing technology

determines the product design, and this further increases the lag behind world standards.

Participation in international labor division and expanding cooperation and specialization relations made the use of more up-to-date production methods possible. In half of machine production, mass production represents an optimal proportion of two-thirds. But only one-sixth of the products are made by mass production. There is a lag in prefabrication technology. The use of machines within the working hours has not improved adequately. Automation is scarce, amounting to about 6 percent. The increase of output is made difficult by an inadequate supply and quality of tools. The use of machines has been 1.2 shifts for a long time. The use of valuable and efficient equipment has somewhat improved, amounting at present to 1.8-1.9 shifts. There are many machines and pieces equipment; their number exceeds the number of people working with machines by 75 percent. The average life of the machines is 10.6 years. The number of totally depreciated machines is significant. Scrapping of obsolete machines is slow.

The volume of investments set to go in the machine industry between 1961 and 1977 constituted 17 percent of the industry's investments, and this proved to be inadequate for achieving an appropriate level of technical paraphernalia. The proportion of investments in the machine industry was low on the basis of international comparisons as well. One-fifth of the investment sources was concentrated on high-priority-developments in the telecommunication and transport vehicle industries. The central development program for highway vehicles has come to a successful end, and the central development program for computer technology is also making good progress.

The following conclusions may be drawn from the technical development of the machine industry's sub-branches:

--the amounts of money allotted for research and development alone indicate that the so-called background industry is not adequately developed. This refers to the fact that the metalware industry that plays such an important role in the production of parts and partial units, makes the least use of the technical development sources among the sub-branches.

--in the state industry, 65 percent of the production increase during the Fifth Five-Year Plan period was achieved by a development of technology. Of the machine industry's sub-branches, only the vehicle production approximates this ratio. We know, however, that vehicle development had a high priority in the past period. We can state, then, that the machine industry's sub-branches, with one exception, had a smaller share of the investments than the state industry's other branches.

--the majority of the machine industry's sub-branches achieved a production increase basically through an increase of staff. We cannot rely on

this in the future; therefore our resources must be concentrated primarily on technological development. This requires an improvement of investment possibilities and an increase of technical equipment.

In order to develop production technology and the so-called background industry more intensively, the material and intellectual resources must be more concentrated. In the technologies used in the other production branches (casting, forging, cold-pressing, cutting, assembly, etc.), the main direction of development is the improvement of quality and tolerance on the one hand, and the increase of mechanization and automation on the other. The most urgent tasks include the decrease of human labor in assembling and material handling.

The Hungarian Academy of Sciences and the other institutions of higher education must be invited to play a larger role in accelerating technological research and development. The possibilities of technical and scientific cooperation between the socialist countries must be better exploited in this area as well. We must provide enough financial incentives for the researchers so that technological development becomes more attractive.

Inferior Work?

In the machine industry, 9 percent of the technical development fund is used for the acquisition of foreign blueprints and technical innovations. This ratio, in international comparison, is low. Technical and scientific cooperation between the socialist countries must be better promoted than before. The ratio of production based on foreign licenses is 15 percent, most of which is concentrated on export production.

Ratios of Production Based on Licenses in the
Branches of the Machine Industry in 1978

Sub-branches	Production based on licenses, in billion forints	Total production in percent
Machines and machine equipment	3.5	11.7
Transport conveyances	7.3	13.8
Electric machines and equipment	6.8	25.6
Telecommunication	5.5	17.1
Precision engineering	1.7	11.5
Metalware industry	1.4	8.7
Machine industry's total	26.2	16.6

The institutions and research laboratories still do not pay enough attention to the possibilities in international scientific labor division. They consider the acquisition and adaption of foreign achievements as an inferior scientific activity. In 90 percent of the cases, the demand for a license of knowhow will not originate from research institutions and laboratories, for they do not consider the adaptation and further development of these as real research or a basis of scientific work.

In spite of the progress in recent years, the purchase and use of licenses has been lagging behind the possible and necessary rate. Haphazard planning had a breaking effect on an even wider use of licenses. License purchasing and domestic research are not always coordinated or made to compete with one another; the employment of two developing methods that compliment each other is rare. The purchase of licenses and new production processes must be prepared more carefully, so that they can better serve the production system's updating. It should be examined at every developmental goal whether it can be better realized through a purchase of a license or a foreign production method.

At present, market research still is not an integral part of every machine industrial enterprise's activity and thus it has not enough effect on technical development which cannot, in turn, affect market research either. Good market research in most cases also leads to successful purchases of licenses and even to new possibilities of cooperation. In order to better prepare the Sixth Five-Year Plan period's technical development activity and to speed up the purchase of intellectual achievements needed for the production structure's development, a branch strategy that is coordinated with the machine industry's structure policy and is connected with the purchase of intellectual achievements and the acceleration thereof, must be made as soon as possible on the basis of the need for licenses as included in the national research plans and the plans of the enterprises and institutions. We should encourage and support the acquisition, first of all, of foreign technical knowhow which speed up the process of research and development; which aid the adoptation of up-to-date products, technologies and knowhow in labor and plant organization; which increase production efficiency; which result in significant volumes of profitable exports; and which aid the realization of CEMA programs and establish long-range relations in development, production and trade.

9414
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HUNGARY DEVELOPING AUDIO-VISUAL MAN-MACHINE INTERFACE

Budapest NEPSZABADSAG in Hungarian 13 Jun 80 p 4

[Article by Pal Petho-Gabor: "First Steps Toward a 'Public Utility Computer'; Researchers and Manufacturers Making Computers More Intelligent"]

[Text] Electronic computers are often called "thinking machines." But when people talk about the possibilities of the not too distant future, when a computer terminal will be in every home, the starting point is always that people will have to learn one of the machine languages such as Algol, Fortran, Cobol, etc.

But the researchers do not go along with this: "Why should people accommodate to the machine?" some of them ask. "The machine should accommodate to people; it should learn to understand them, see them and hear them without data carriers!"

All this is not sheer fantasy or the music of the future; some of the solutions are already working and even being manufactured. And what is incredible to many--in Hungary.

From Machine Eye to Human Eye

Readers already know the name of the Computer Technology Coordination Institute (SZKI) in connection with the uniform computer technology system of the socialist countries, the ESZR. It should be added, however, that the name of this institution is misleading; it is far from being a "budgetary institution," rather it is a computer technology research and development institution managed in an enterprise system.

Dr Jozsef Denes, a main department chief and a mathematician, and his colleagues have been working for years to teach a computer to "see" and then to "hear." As he puts it, they are trying to develop a "public utility computer."

"In order to use the telephone, listen to the radio, watch television, get water from the tap or make use of technical achievements already classified

as public utility services we do not have to know how the water gets into the tap or what is inside the telephone exchange or the television set," he says. "We turn the tap, pick up the telephone or punch the button--and the rest is none of our concern.

"Computer applications are spreading at a swift rate and soon they will become services, invading private life and the home. They will not perform calculations but will do what they do already--provide information, process information, etc. It cannot be imagined that everyone will learn even the simplest artificial language. The computer will have to understand us. This is the first step toward a public utility computer.

"Inseparable from this effort is the requirement that it not be done with special (and expensive) equipment but rather by building up a system using units suitable for other purposes and already in use.

"The 'eye' of the system is a TV camera. Nothing special, but just a camera in series manufacture. The camera sees. For example, we could put a photograph or typed text in front of it but it could also 'look' at constantly moving objects such as the products of a machine which flow out at a rate of hundreds or thousands per minute. The picture which the camera sees is transformed into signals. The picture goes into the memory of the computer in a fiftieth of a second.

"The transmission of the picture is controlled by the program, by the software, of the computer. The same applies to the reconstitution of stored pictures and their display on a screen. The program--actually various programs for special tasks--has been developed in the SZKI.

"We have also developed in the SZKI the television type color graphic raster display unit which is indispensable for the solution of these picture processing tasks. (This invention is now being patented.) It was not an exactly well known idea to use a picture tape recorder as a storage unit.

"The system is capable of transforming and storing the pictures coming through the 'eye', of renewing them again and again or of abandoning the older ones. Even more important, it is capable of copying the pictures on the screen one after another and thus comparing them. It can prepare statistics about the content of the picture and display the result on a color graph. Enlargement, reduction, transposing details and recoloring are all easy tasks for the machine. In the above example the machine could perform 'quality control' because it compares the picture of every product with the model stored in memory and if there is a deviation it immediately signals or can even intervene and stop the manufacturing machine."

Picture Processing

"This is what we call picture processing," Denes concludes.

Everything I saw in the laboratory of the SZKI made it clear that this is very practical research. But will Hungarian industry accept it? In

recent years we could read and hear about much such research and in more than one case it sadly ended in failure.

But on some of the elements of the picture processing system--the TV camera, the microcomputer, the color monitor--there was a sign which suggested that here I might be able to report on work which sounds more optimistic. The equipment mentioned bore the emblem of the Signal Technology Cooperative (HT).

As for the camera and the monitor, they were developed earlier for other purposes and have been manufactured in this cooperative. What about the rest?

Dr Jozsef Denes said that when his research was ready for introduction and they needed the cooperation of an industrial plant for the next step they began looking for a partner. This was hardly an easier task than solving the technical problems. They could not come to an agreement in a short time with the large industrial enterprises. Then they found the Signal Technology Cooperative which in turn was seeking, and is constantly seeking, new electronic products and is cooperating, for example, with the largest Hungarian research center, the Central Physics Research Institute (KFKI) of the Hungarian Academy of Sciences, and with the Computer Technology and Automation Research Institute.

If we hear about an industrial cooperative in connection with industry we usually think of a small plant made up of a number of artisans. The Signal Technology ooperative used to be like that but now it is a medium size plant employing 1,600 workers including more than 200 engineers. It is oriented toward one-time products and small series and its economic success proves that this is a good direction.

Lajos Koveskuti, the state prize winning president of the Signal Technology Cooperative says:

"We deal with television technology and the development and manufacture of measuring instruments and equipment and now all of this is beginning to be 'built on' computer technology. This is how we got together with the Computer Technology Coordination Institute, among others. We developed an extraordinarily light sensitive camera which can virtually see in the dark--with a light strength of one millilux--and we wanted to make its pictures storable and readable with great speed. Obviously this was possible only by means of computer technology. So we needed a high speed microcomputer.

"Since we could not buy one we developed one ourselves. But there was no sense in our undertaking to develop the software, the program, because we knew that the SZKI is a virtual software factory; so we relied on their help and knowledge."

Attila Fekete, one of the leaders of technical development at the cooperative, adds:

"The cooperation and the realization of manufacture are especially instructive--and probably this is the secret of success--because the creative work and the work of implementation were not separated from one another; they did not 'do research' at the SZKI and 'introduce' it at the HT. Certain parts were worked out here and others there; as it turned out some of the SZKI people worked for months in the cooperative together with its developmental engineers and vice versa. Probably only the files preserve the origin of the subassemblies; what the participants in the work remember is that 'we put it together then' but whose it was and who did it they no longer know."

An Interesting Interest

In addition to uniting on the work the organic unity of the interest was a great motivating force:

"We tried," Lajos Koveskuti says, "to make our research institute partners interested not only in the development of a product but also to an increased degree in seeing that it should be a product which could be manufactured economically, which could be marketed well on every market; even in the developmental phase. So we paid only a minimal sum directly for development; in essence we covered the cost of documentation. We are paying a definite percentage key out of the price income from every unit sold of products being manufactured and we are sharing the surplus profits. If the product includes a patent then the percentage key increases in order to cover the inventor's fee of the inventor.

"If our profit from a product is higher than the average profit generated by the products of the cooperative then the research institute gets a part of this higher profit; the proportion of the share increases with the increase in the profit."

"At the end of 1978 we took over the TPA-L computer of the KFKI and in 1979 we produced ten of them," Attila Fekete says. "The display we are manufacturing, which was developed together with the SZKI, has a modular system and can display a black and white picture on a 64 scale, which is as rich in detail as a photograph. Since colors can be used too it can also be used to display 64 shades of color.

"The sphere of applications for picture processing is broader than we could have imagined," the young expert says enthusiastically.

They have a number of foreign and domestic orders for quite different applications areas, not only for 1980 but already for 1981 too.

"Going beyond the orders, the good quality of the picture processing system developed together with the SZKI is proven by the fact," the president says in conclusion, "that we will use it in our own production too, for example in checking unassembled and assembled printed circuit panels."

As we said, we know many cases in which Hungarian industry is unable or unwilling to accept new technical creations. It is to be hoped that this positive example will encourage and will be followed by researchers and manufacturers alike.

8984
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BRIEFS

SCIENTISTS REPORT ON INTERFERON RESEARCH--For about 10 years the virus laboratory of the Microbiological Research Group of the Hungarian Academy of Sciences has been conducting research on Interferon in collaboration with researchers of the socialist countries. For several years we have been investigating the radiation protecting effect of substances which produce Interferon. Efforts are being made to determine the protecting effect against X-ray, gamma, alfa particles and neutrons. We conduct our investigations with acute radiation: massive doses of short duration as well as smaller doses over a prolonged period. To date results indicate that Interferon inductors have good radiation protection effects: they protect the system from the damaging effects of even prolonged radiation. Our laboratory investigated hypoxia and hypodynamia as stress factors. Findings indicate that these stress factors can reduce Interferon synthesis and thereby reduce the system's resistance to disease. [By Dr Margit Talas, Laslo Balkia] [Excerpts] [Budapest MAGYAR HIRLAP in Hungarian 18 May 80 p 11]

CSO: 2502

CHANGES IN HYPOTHALAMIC NORADRENALINE AND 5-HYDROXYTRYPTAMINE LEVELS DURING THE DEVELOPMENT OF WARM- AND COLD-ADAPTATION IN THE RAT

Budapest ACTA PHYSIOLOGICA ACADEMIAE SCIENTIARUM HUNGARICAE in English Vol 54 No 3, 30 Apr 80 pp 245-249 manuscript received 14 Feb 79

HAHN, ZOLTAN, Institute of Physiology, and SZELENYI, ZOLTAN, Institute of Pathophysiology, both at the University of Medical Sciences, Pecs

[Abstract] Tests aimed at elucidating the role played by 5-hydroxytryptamine (5-HT) and noradrenaline (NA) levels in the hypothalamus in the development of warm- and cold-adaptation in the rat were carried out on 1.5 month old rats (CFY strain). Changes occurred in the hypothalamic monoamine levels by the end of the first week of thermal adaptation. The initial drop in hypothalamic 5-HT content observed in both cold and warm adaptation may be interpreted as a result of nonspecific stress. During the late phase of cold-adaptation, the 5-HT level returned to the pre-exposure content slowly, while in warm-adaptation it increased slowly toward the pre-exposure level. The balance of hypothalamic NA and 5-HT might play some role in thermal adaptation. However, the data obtained provide no information on the kinetics of monoamine synthesis and breakdown, and thus on the amount of transmitters actually available for neural processes. The change in the balance of hypothalamic amines in favor of NA during warm-adaptation may confirm the hypothesis that another homeothermic species, the guinea pig, central noradrenergic activity may be higher in the warm-adapted than in the cold-adapted state.

Figure 1; references 11: 2 German, 1 Hungarian, and 8 Western

2542
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UDC: 669.715.018.295:620.197.2

TESTING OF STRESS CORROSION IN HIGH-STRENGTH ALUMINUM ALLOYS

Budapest BANYASZATI ES KOHASZATI LAPOK - KOHASZAT in Hungarian Vol 113 No 1, Jan 80 pp 45-48

VITALIS, LASZLO, Dr., graduate chemical engineer, Aluminum Planning and Research Institute

[Abstract] The propagation rate of stress-corrosion cracks as a function of the stress-intensity coefficient was measured in high-strength aluminum alloys (4.8 percent Zn, 2.4 percent Mg, 0.7 percent Cu, 0.28 percent Fe, 0.25 percent Si, 0.1 percent Cr, 0.15 percent Mn, 0.04 percent Ti, 0.05 percent Zr, and the rest Al) by means of the double cantilever beam test after various kinds of heat treatment. The purpose of the study was to establish the test procedure best suited for series testing to obtain dependable information about the corrosion-sensitivity of the alloys in a fast, economical, and accurate manner. The test procedure described involved the casting of ingots at 993°K, homogenization for 12 hours at 750°K, pressing of tubes (148 mm/113 mm diameter) at 720°K, and cutting 12 x 12 x 120 mm specimens for the test. Results of tests with this method were presented and compared with data reported in the literature. It was concluded that the method is suitable for the intended purpose and should be regularly used to forecast the lifetime of parts made of high-strength aluminum alloys. The method was also highly selective. Figures 6; references 4: 1 Hungarian and 3 Western.

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UDC: 621.774.3

FUNDAMENTAL PROBLEMS OF STEEL-TUBE MANUFACTURE DEVELOPMENT IN HUNGARY

Budapest BANYASZATI ES KOHASZATI LAPOK - KOHASZAT in Hungarian Vol 113 No 2, Feb 80 pp 68-73

MOLNAR, JANOS, graduate metallurgical engineer, Planning Institute, Csepel Works

[Abstract] The article discusses the last 50 years of the growth of seamless steel-tube manufacture at Csepel Works, with special emphasis on investment considerations. It then compares the expected domestic needs for seamless steel tubes with the production capabilities of the factory without further development and investments. It concludes that development, involving additional investments, is urgently required. The economic tasks to be met for meeting the expected increased demand are discussed. The choice between new investments in production capacity (estimated in the neighborhood of 10 billion forints till 1985) and importation of the excess demand was evaluated. In this respect it was concluded that the domestic development is preferable. A second consideration was whether welded or seamless tube manufacture should be preferentially developed. The development should be completed by the end of the Sixth Five-Year Plan period. For this to be possible, the planning work must be completed by the first half of 1980, Figures 7; references 6: all Hungarian.

2542
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COMPUTER OPERATING RELIABILITY DESCRIBED

Warsaw INFORMATYKA in Polish No 4, Apr 80 pp 4-8

[Article by Wieslaw Dmochowski of the MERA-ELWRO Center for Computer Systems for Automatics and Measurements, Wroclaw: "Operating Reliability for the ODRA 1305 and EC 1032 Computer Systems"]

[Excerpts] Problems associated with the operating reliability of computers were discussed in the articles by Boleslaw Gliksman ("Operating Results of the ZETO [Electronic Computer Institute] JS EMC [Uniform System of Electronic Digital Computers] in Katowice," INFORMATYKA, No 7-8/78) and Wit Drewniak ("Reliability of ODRA 1305 and R-32 Computer Systems," INFORMATYKA, No 7/79). Because the given indicators were not comparable and different methods were used to record results, the data supplied by the above authors are not compatible with data supplied by ZETO Katowice and the GUS [Main Office for Statistics] technical service centers in Warsaw which were transmitted to the MERA-ELWRO Center for Computer Systems for Automatics and Measurements [CKSAiP].

This article continues the discussion on computer hardware reliability, and, in addition to evaluating operating reliability, it lists methods of improving computer hardware operating reliability.

Comparison of Reliabilities of Computer Hardware Manufactured by Poland and ICL

When qualifying reliability, one must take into consideration the component base, loads imposed on the components and specific equipment, operating conditions, and number of pieces of backup equipment, types of backup equipment and renovations used, the effectiveness of preventive maintenance and functional configuration.

Among other things, computer hardware operating results show that the qualifications and experience of computer center personnel affect quality of hardware operation and hardware utilization. To eliminate the effects of technical service quality (maintenance, repair and preventive maintenance) on reliability, the operating failure rate, comparisons were made for the component base produced in Poland and that produced by ICL.

In evaluating reliability based on failure rates of the component base, the number of individual electronic components and the total number of solder joints, connections and contacts are taken into account.

As calculated, the average mean time between failures (MTBF) for the EC 2032/256KB is 698 hours when ICL components are used and 65.5 hours when Polish made components are used. The calculations show that Polish-made transistors significantly affect reliability (especially operating and read-only memory reliabilities).

Through the application of results of specific reliability studies--that is, by reducing electrical loads, improving cooling conditions, introducing circuits that protect against damage during connect and disconnect, introducing proper selection of components, and the aging and vibrating of memory units--the failure rate for currently produced operating memories has declined significantly.

The use in a processor of electrical loads less than 0.5, the introduction of 37 design changes in the logic structure, improved operating precision and the introduction of 200 hours of initial operation for systems in in-use configurations improved the EC 2032/256KB MTBF to 140 hours.

Operating Reliability Indicators

The reliability indicators for the ODRA 1300 and EC 1032 computer systems modules (table 1) are based on the quarterly polls "Summary Compilation of Computer Hardware Operating Times" and "Summary Compilation of Failed Components and Subassemblies" which were sent to MERA-ELWRO CKSAiP. ELWRO was required to conduct such polling by the National Technical Service Organization [KOOT] based on the agreements with the Coordination Center for the International Commission for Electronic Computer Computations within CEMA.

Tables 2 and 3 present reliability indicators for computer systems operated by GUS Warsaw and ZETO Katowice and are based on data obtained from ELWRO. The tables show that the named systems cannot be compared with one another because there are differences in their functional configurations and in the number of auxiliary pieces of equipment used with each configuration. In order for the analyses to be comparable, it is necessary to characterize percisely system tasks to establish proper equipment utilization proportions, and to make use of comparisons of standard tasks.

Table 1. Reliability Indicators for Modules of the ODRA 1300 and EC 1032 Computer Systems.

	Urządzenie (1)	Średnia liczba badanych urządzeń (2)			Łączny czas pracy T_{Σ} [h] (3)			T_{λ} [h] (4)			K_{gr} (5)		
		1976	1977	1978	1976	1977	1978	1976	1977	1978	1976	1977	1978
	ODRA 1305/96K	6	13	19	15984	44177	[illegible]	40,8 (64K)	88,4	140	0,98 (64K)	0,978	0,976
	ODRA 1325/32K	4	5	6	10097	14084	21888	48,4	136,7	202	0,96	0,976	0,974
	EC 1032/256KB	3	5	12	2118	11119	29730	41,5	119,5	139,4	0,86	0,920	0,943
6.	MTS 304/1305	5	17	24	17230	53812	75821	248,7	180	801	0,99	0,986	0,985
6.	MTS 304/1325	4	3	6	10396	17286	17293	315	608,9	600	0,98	0,987	0,985
	EC 5517	—	6	10	—	12583	15872	—	644	1143	—	0,979	0,984
7.	PT 331/1305	38	88	140	105522	278519	458994	473	886	882	0,99	0,987	0,987
7.	PT 331/1325	24	24	36	29217	64750	98097	470	871	828	0,99	0,981	0,965
	EC 5019	—	39	62	—	64232	150352	—	841	763	—	0,973	0,988
	EC 5562	—	6	8	—	18829	19098	—	197	1131	—	0,967	0,982
	EC 5052	—	19	22	—	49501	114126	—	410	867	—	0,970	0,990
8.	DW 325/1305	5	15	22	13564	47306	68791	73	140	178	0,96	0,978	0,975
8.	DW 325/1325	4	3	8	6677	17229	22160	68	148	183	0,97	0,987	0,988
	EC 7033	5	7	16	4021	17480	39420	309	253	375	0,98	0,983	0,970
9.	CK 304/1305	5	15	22	25666	49656	72229	133	139	370	0,97	0,968	0,975
9.	CK 304/1325	4	5	6	14643	10002	19565	138	141	341	0,98	0,980	0,998
	EC 6016	4	8	10	2860	16849	30887	240	186	320	0,98	0,971	0,911
10.	CDT 325/1305	5	—	17	14745	—	47618	283	—	636	0,98	—	0,992
10.	CDT 325/1325	4	5	7	10665	15720	22464	236	570	1081	0,99	0,987	0,998
	EC 7014	—	—	8	—	—	10843	—	—	230	—	—	0,994

Key:

1. Equipment
2. Average number of equipment investigated
3. Total operating time (hours)
4. Average time between failures (hours)
5. Configuration readiness factor
6. Control unit
7. Tape Memory
8. Line Printer
9. Card Reader
10. Reader/tape punch

Table 2. Reliability Indicators for Computer Configurations at GUS Warsaw

(1) Konfiguracja zestawu	(2) Okres (kwartał 1978 r.)	(3) Łączny czas pracy efektywnej [h]	(4) Łączny czas trwania uszkodzeń [h]	(5) Liczba uszkodzeń	(6) Obsługa profilaktyczna [h]	(7) $T_{śr}$ [h]	(8) T_p [h]	(9) K_{sr}	K_g
(10) JC 1305/96K egz. nr 197, (11) F-306, DW-325 (12) CK-304, PT-3Mx6(13) (14) MTS-304	II	1200	90,5	30	90,5	43,2	3,3	[illegible]	[illegible]
	III	1843	108,5	35 (3)	107	38,4	3,0	[illegible]	[illegible]
JC 1305/128 K, egz. nr 208, (15) F-305	II	2076	121	41 (18)	180	50,6	2,9	0,944	[illegible]
(16) (11) (12) (13) CDT-325, DW-325, CK-304, PT-3×M6 (14) MTS-304	III	2145	93,5	65 (6)	278	38,0	1,4	[illegible]	[illegible]
(17) JC 1305/128 K, egz. nr 232, F-305, (11) DW-325, CK-325, (18) (12) CK-304, MTS-304×2 (19) (20) PT-3M×10, PDS-325 (21) EC-5052×6	II	2218	279	68 (4)	115	33,5	4,1	[illegible]	[illegible]
	III	2341	94	42 (1)	97	38,7	2,2	0,961	[illegible]
EC 2032/256KB, egz. nr 021, (22) K-30, EC-7076, EC-6016×2 EC-7033×2, EC-5517×2, EC-5019×8, EC-6061×2, EC-6061×8, EC-5551, EC-5052×4	II	617	91	14 (4)	104,5	14,0	2,0	0,871	0,780
	III	610	158	16	106	40,6	10,4	0,795	0,700

(Key on following page)

Key:

1. Configuration
2. Period (1978 quarter)
3. Total effective operating time (hours)
4. Total duration of failures (hours)
5. Number of failures
6. Preventive maintenance service (hours)
7. Average time between functional configuration failures (hours)
8. Average equipment repair time (hours)
9. Configuration readiness factor
10. Copy No. 197
11. Line printer DW-325
12. Card reader CK-304
13. Tape memory PT-3Mx6
14. Control unit MTS-304
15. Copy No. 208
16. Reader/tape punch CDT-325
17. Copy No. 233
18. Card Reader CK-325
19. Control unit MTS-304x2
20. Tape memory PT-3Mx10
21. [Disk memory] PDS-325
22. Copy No. 021

The systems presented have different configurations which lead to differentiated uses and loadings of specific equipment, and these factors affect their failure rates.

This applies in particular to electromechanical equipment whose MTBF is determined by the loads imposed on electromechanical subassemblies. For example, T for the EC 7033 printer is estimated to be 1,000 hours when printing $6.5x10^6$ lines and about 100 hours when printing $6.5x10^7$ lines.

The effectiveness of preventive maintenance operations is another problem. In the table 2 "number of failures" column, the number of failures which could be eliminated during preventive maintenance is listed in parentheses. Such failures include time-meter fan and projection defects and so forth if they do not affect proper equipment operation.

Table 3. Reliability Indicators for ZETO Katowice Computer Configurations

(1) Konfiguracja zestawu	(2) Okres (kwartał 1978 r.)	(3) Łączny czas pracy efektywnej [h]	(4) Łączny czas trwania uszkodzeń [h]	(5) Liczba uszkodzeń	(6) Obsługa profilaktyczna [h]	(7) T_{1f} [h]	(8) T_{n} [h]	(9) K_{w}	K_{gf}
EC 2020/256KB, egz. nr 080, EC 6012, EC 7033, EC 5511, EC 5012×6, EC 5551, EC 5052×4 (10)	I	1039	24	16	173	74,2	1,7	0,877	0,840
	II	1195	5	4	153	299	1,25	0,995	[illegible]
	III	1966	34,5	25	173	54,7	1,38	0,975	[illegible]
EC 2022/512 KB, egz. nr 035, EC 6012×2, EC 7033, EC 5517, EC 5012×6, EC 6022×2 (11)	I	1473	1229,4	44	142	33,4	27,9	0,545	0,517
	II	2091	1154	37	64	54,9	30,8	0,641	[illegible]
	III	2080	1941	47	70	44,2	20,1	0,539	[illegible]
	IV	1979	1215	30	71	65,9	40,5	0,619	[illegible]
EC 2032/256 KB, egz. nr 023, EC 6016×2, EC 7033, EC 7014, EC 5517, EC 5561, EC 5019×6, EC 5052×4 (12)	I	477	93	23	79	21,1	22,9	0,879	0,797
	II	1024	100	23	115	44,7	45,0	[illegible]	[illegible]
	III	1340	365	22	120	38,7	12,0	0,763	0,710
	IV	1650	132	31	118	53,7	4,2	[illegible]	[illegible]

Key:

1. Computer configuration
2. Period (1978 quarter)
3. Total effective operating time (hours)
4. Total duration of failures (hours)
5. Number of failures
6. Preventive maintenance service (hours)
7. Average time between functional configuration failures (hours)
8. Average equipment repair time (hours)
9. Configuration readiness factor
10. Copy No 080
11. Copy No 035
12. Copy No 023

The MERA-ELWRO CKSAiP reliability service, in its column "Guide for MERA-ELWRO Computer Users", contains on a regular basis a section on computer users who achieve the best operating results. According to the 1st quarter 1979 data, among the best are:

The PONAR Special Machine Tools Factory, Poznan. Configuration:EC 2032/-256KB copy no. 048, EC 5551, EC 5052x4, EC 5561, EC 5061x4, EC 5517, EC 4019x6, EC 7033x2, EC 6016; T_λ= 89 hours;

The MERA-LUMEL Electrical Apparatus Plants, Zielona Gora. Configuration" ODRA 1305/64K copy no. 191, F-305, CDT-325, DW-325, MTS-304, PT-3Mx10; T_λ = 93 hours;

The Jankowskie Soda Plants, Jankowo. Configuration: ODRA 1325/32K copy no. 107, F-325, CDT-325, DW-325, CK-304, MTS-304, PT-3Mx6; T_λ = 148 hours.

Practical Evaluation of Reliability

Operating reliability indicators can vary over a wide range depending on the number of pieces of equipment in a computer configuration, operating memory, and character and rate of computations. Thus for the ODRA 1305 configurations installed at GUS Warsaw, the MTBF varies from 32.5 to 55.7 hours (see table 2), but for the EC 1032 installed at ZETO Katowice, it varies from 21.1 to 53.7 hours (see table 3).

Depending on the tasks performed by a system, appropriate requirements for functional reliability indicators should be set. Using on these requirements, one in turn can specify the number of basic and reserve equipment, types of reserves and the failure rate of a system.

Fulfilling reliability requirements should affect functional reliability evaluations to ensure the execution of basic functions by a system. Knowledge of electromechanical equipment loading, minimal configuration and full configuration are necessary to evaluate such reliability. Evaluations of reliability indicators for individual types of equipment should be conducted separately. Such an evaluation is significantly more detailed than those undertaken by GUS Warsaw and ZETO Katowice whose evaluations of the ODRA 1305 and R-32 (EC 1032) computer reliabilities did not always consider the computers as rigorously defined collections of equipment.

Improving Operational Reliability

Increasingly complex logic structures, increased operating and external memory capacities, and increased data transmission speeds must lead to more data control and safeguards. This requires the use of redundancy methods for hardware as well as software. These methods are:

Structural (method of reserving systems and their component parts or equipment); Informational (method using codes to protect against interferences, and using reliable algorithms for processing data, reserve channels for transmitting data and control of data processing);

Time (method that uses frequent repetition of tasks, their contents, instructions and operations);

Diagnostic (method that uses apparatus and programs to diagnose the technical status of systems and their components);

Ergonomic (method that uses division of functions concerning system control vis-a-vis the operator and system as well as its own work organization at the operator's work place);

Physical (method that takes into consideration additional margins of safety, that is, electrical, mechanical and climatic margins and that considers the selection of optimum operating conditions and optimum technology).

The systemic, structural and informational methods are applied extensively at MERA-ELWRO CKSAiP when designing new systems; these can tolerate environment errors as well as their own failures and errors.

The use in memories of detection codes with error correction and the reconfiguration of memory when expanding hardware 7 percent should increase time between errors 2.5 times.

Similarly, the physical method, which is used when designing reliability in new equipment, is given high priority.

Much emphasis was placed on the diagnostic method in the currently produced EC 2032 processor. This is reflected in the TLUP, TLUK and TPAS diagnostic tests for the processor, in the SER 0 and SER 1 system status registration programs, and in the EREP and SEREP editing and error printing programs.

Because the EC 2032 operating system is not very resistant to hardware errors, the SER programs are now being modernized in order to improve mechanisms to isolate processor failures in such a way as to fully utilize the possibility of reconfiguring memory and built-in diagnostic and control circuits.

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